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Commentary: Does the 'hygiene hypothesis' provide an explanation for the relatively low prevalence of asthma in Bangladesh?

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The prevalence of childhood asthma in Bangladesh is much lower than in developed countries, but similar to those of other countries in this region like Pakistan and India.[1] These differences in asthma prevalence may be attributed to a 'western lifestyle', which among other factors is characterized by a higher level of hygiene, lower rates of infections, and small family size. Among the Bangladeshi children, those living in small families (three or less people) were more likely to suffer from asthma. The observation of an inverse relation between sibship size and atopy formed the basis of what is known today as the 'hygiene hypothesis'.[2] The immunological extension of this concept is the distinction of Th1 and Th2 lymphocyte populations in laboratory animals and the recognition that 'natural immunity'

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to bacterial and viral infections induce a Th1 pattern of cytokine release, potentially suppressing the Th2 immune response involved in IgE mediated allergy. Thus, changes in the level of stimulation from the microbial environment associated with improvements in public health and hygiene may have indirectly influenced the postnatal development of immune functions, so as to increase predisposition to chronic allergic conditions during childhood.[3]

The high rates of respiratory infections, tuberculosis, measles and helminths infections in Bangladeshi children might thus contribute to lower rates of allergy. There is, however, conflicting evidence whether early (viral) infections may enhance or decrease the risk of developing asthma. A recent longitudinal birth cohort study from Germany showed that repeated lower respiratory tract infections early in life were positively associated with subsequent development of asthma, wheeze, and bronchial hyperreactivity. In contrast, early episodes of other infections (particularly viral infections) were inversely related to the development of asthma at age 7.[4] Reverse causation seems a plausible explanation for the positive association between lower respiratory tract infections and subsequent wheeze and asthma, with lower respiratory tract infections being predictors of, rather than risk factors for, asthma.

Epidemiological evidence supporting the 'hygiene hypothesis' can further be found in studies of Italian military cadets. Respiratory allergies were less frequent in cadets with antibodies against hepatitis A virus and were inversely related to other orofecal and foodborne infections.[5] These types of infections are likely to play an important role in countries like Bangladesh.

Studies in rural areas of Central Europe have shown that growing up on a farm and more specifically contact to farm animals was associated with a substantial decrease in risk for the development of hay fever and asthma, when children from farming families were compared to their peers living in the same villages.[6,7] Whether increased exposure to microbial compounds has to occur early in life to affect maturation of the immune system, thereby reducing the risk for development of allergic diseases has recently been investigated in a cross-sectional study in Switzerland, Austria and Germany.[8] Exposure of children younger than one year, compared with those aged 1–5 years, to stables and consumption of farm milk was associated with lower frequencies of asthma, hay fever and atopic sensitization. The results of these studies provide further evidence for the hygiene hypothesis and may in part explain the lower rates of asthma and allergy found in rural communities as compared to urban ones.

In Bangladesh, asthma was equally prevalent in metropolitan areas, in other urban areas and in rural areas. Thus, the effect of farming seen in European studies was not observed in Bangladesh. In a recent case-control study on indoor exposures and childhood asthma in Nepal, keeping cattle inside of the family home was associated with a risk reduction for asthma whereas keeping cattle outside of the home had no protective effect.[9] Thus, it is conceivable that there might be variations in asthma prevalence in Bangladesh associated with keeping cattle indoors. Alternatively, if exposure to infections and unhygienic drinking water is the main source of microbial stimulation of Bangladeshi children, and if these exposures are evenly distributed between metropolitan areas, urban areas and rural communities, no variation in asthma prevalence would be expected.

In conclusion, the hygiene hypothesis may at least in part explain the lower prevalence of asthma observed in Bangladesh as compared to developed countries. However, the prevalence of asthma in Bangladesh is substantial and represents an important public health problem which might increase in parallel with the economical development of the country.

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